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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF CIVIL AVIATION

SYLLABUS

OF

EXAMINATIONS

FOR

GROUND ENGINEERS' LICENCES

ISSUED UNDER THE
AIR NAVIGATION REGULATIONS

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SYLLABUS OF EXAMINATIONS

FOR

GROUND ENGINEERS' LICENCES.

1. Examinations for the issue of Ground Engineers' Licences and extensions to existing licences under the Air Navigation Regulations are conducted by the Department of Civil Aviation as follow:—

BRISBANE, SYDNEY, MELBOURNE, ADELAIDE, AND PERTH.—First Wednesday in February, May, August, and November of each year.

OTHER CENTRES.—On the occasion of the periodical visits of Departmental Aircraft Inspectors.

(The above dates will be strictly adhered to unless otherwise notified publicly.)

2. Application for Ground Engineer's Licence or extension to existing Licence should be made on C.A. Forms 3 or 3A, which are obtainable on request, and should be addressed to the District Superintendent, Aerodrome, Mascot, New South Wales; Officer-in-Charge, Aerodromes, Maylands, Western Australia; Brisbane, Queensland; Parafield, South Australia; or Essendon, Victoria.

3. Applications must be received at least twenty-one (21) days prior to the date of the examination at which the candidate desires to sit.

4. Candidates are particularly to note that in order to qualify for a Licence in Division "A" they must also qualify in the subjects listed under Division "C," and for a Licence in Division "B" they must also qualify in the subjects listed under Division "D."

5. Licences will not be issued to persons under the age of 21 years.

6. Candidates may apply to be licensed in one, several, or all of the following divisions, which are briefly defined hereunder:—

DIVISION "A."

INSPECTION OF AIRCRAFT UNDERGOING COMPLETE OVERHAUL.

7. A Ground Engineer licensed in this division is empowered to certify that aircraft have been repaired or overhauled in accordance with the requirements of the Director-General of Civil Aviation. The Aircraft Inspection Reports (C.A. Forms 50 and 161) in so far as they relate to the aircraft for renewal and/or removal of suspension of Certificate of Airworthiness, must be furnished by the holder of a Licence in this Division.

DIVISION "B."

INSPECTION OF AERO ENGINES UNDERGOING COMPLETE OVERHAUL.

8. A Ground Engineer licensed in this division is empowered to certify that aircraft engines have been repaired, overhauled, and tested in accordance with the requirements of the Director-General of Civil Aviation. The Aircraft Inspection Report (C.A. Forms 50 and 161) in so far as they relate to aircraft engines for renewal and/or removal of suspension of Certificate of Airworthiness, must be furnished by the holder of a Licence in this Division.

DIVISION "C."

INSPECTION OF AIRCRAFT BEFORE FLIGHT.

9. All Ground Engineers certifying aircraft as safe for flight in accordance with the Air Navigation Regulations must be licensed in this Division.

They are responsible for inspecting all adjustments for flight and the fitting of spares approved by a Ground Engineer licensed in Division "A," X. (xxxiv) and (xxxv), but cannot approve a constructional repair or the manufacture of a new part.

The holder of a Licence in this Division with endorsement permitting certification of a controllable pitch or constant speed propeller, will, in regard to such propellers, be responsible for verifying the safety of details of the propeller and its controlling mechanism, and for verifying the proper functioning of the propeller and its controlling mechanism. Such a Licence holder may certify to the rectification of minor damage to the faces and edges of solid metal blades but not to the rectification of distorted blades.

DIVISION "D."

INSTALLATION AND INSPECTION OF AERO ENGINES BEFORE FLIGHT.

10. All Ground Engineers certifying aircraft engines as safe for flight in accordance with the Air Navigation Regulations must be licensed in his Division.

They are responsible for inspecting engines and engine installation after any adjustment or the fitting of spares approved by a Ground Engineer holding a licence in Division "B" and X. (xv), and may certify that a top overhaul has been carried out satisfactorily, but cannot approve the manufacture of a new part, or certify a complete overhaul.

The holder of a Licence in this Division with endorsement permitting certification of a controllable pitch or constant speed propeller, will, in regard to such propellers, be responsible for verifying the safety of details of the propeller and its controlling mechanism, and for verifying the proper functioning of the propeller and its controlling mechanism. Such a Licence holder may certify to the rectification of minor damage to the faces and edges of solid metal blades, but not to the rectification of distorted blades.

DIVISION "X."

OTHER PURPOSES FOR WHICH LICENCE IS REQUIRED.

11. Inspection and certification of other work for which a Ground Engineer is licensed under this Division.

CONDITIONS OF ELIGIBILITY FOR EXAMINATION.

12. Applicants to be eligible for examination are required to submit proof that they have acquired the following minimum experience:—

Divisions "A" and "C"—Served at least two years on aircraft construction and/or maintenance.

Divisions "B" and "D"—Served at least two years as a mechanic or engineer on the construction, maintenance, and/or overhaul of aero engines.

Licences will only be issued for the specific types of engines and/or aircraft of which experience has been gained.

If an applicant can produce satisfactory evidence that he is proficient at some similar trade, the minimum periods of experience as set out above may be reduced to one year.

For a licence to cover either Divisions "A" and "B" or "C" and "D", at least three years should be served on joint aero engine and aircraft construction or maintenance.

Division "X"—Have had sufficient practical experience as to enable the applicant to be competent in the particular class of work for which a licence is desired.

13. Service with the R.A.A.F. or R.A.F. may be accepted as fulfilling the requirements set out in the preceding paragraph for candidates for licences in Divisions "C" and "D" provided recent practical experience has been gained in the current types of aircraft and/or aero engines applied for, but will not necessarily (by itself) be accepted for Divisions "A" and "B".

14. Candidates will be required to submit documentary evidence of practical experience with their applications for Licences.

15. Applicants are required to state in C.A. Form 3 the Division or Divisions for which a Licence is desired, the specific types of aero engines and/or aircraft (obsolete types excluded) applied for, and full details of practical experience particularly in regard to aero engines and/or aircraft. It is important that applicants should also indicate that they have obtained a copy and made a study of the Air Navigation Regulations.

16. Ground Engineers' Licences are valid for a period of twelve (12) months, and will then be subject to renewal. The Department reserves the right to re-examine the candidate for renewal if considered necessary.

17. Examinations may be partly written, partly oral, and partly practical, and will be based on the following syliabi:—

DIVISION "A."

INSPECTION OF AIRCRAFT UNDERGOING COMPLETE OVERHAUL.

18. The general principles of the inspection of aircraft construction including:—

(i) For wooden aircraft, knowledge of identification of all species of timber and materials used, together with characteristic defects which render them unsuitable, and the tests that are necessary to prove the quality of such materials. A knowledge of other non-metallic materials and workshop processes such as gluing, fabric covering, doping, varnishing and protective processes against deterioration.

(ii) Knowledge of metallic materials used in aircraft, including their identification and testing. Characteristic defects in metallic materials, their protection against deterioration, and precautions to be observed during processes of manufacture, heat treatment, welding, brazing, soldering, plating, &c.

(iii) For boat seaplanes, knowledge of hull construction and method of checking correct erection and fitting to aircraft, and repair schemes. Knowledge of processes for protection of hulls and floats and metal fittings against corrosion.

(iv) Knowledge of the methods of construction, examination, and testing of aircraft parts and components (fuselages, wings, airscrews, tanks, radiators, pumps, cocks, &c.) of practical points to observe for inspecting such components.

(v) For metal aircraft, knowledge of the specifications covering the manufacture and heat treatment of materials, together with a knowledge of the system adopted by the manufacturer for the manufacture and/or repair of metal aircraft components and/or structures.

(vi) Knowledge of methods of inspecting and testing the complete aircraft for correct assembly; installation of engine controls; fuel, oil, and water systems; instruments; electrical services including bonding and screening, and other appliances.

DIVISION "B."

INSPECTION OF AERO ENGINES UNDERGOING COMPLETE OVERHAUL.

19. The general principles of aero engine inspection including:—

(i) An elementary knowledge of ferrous and non-ferrous materials used in the construction of aero engines, the correct heat treatment and precautions to be observed in any process to which the material is subjected, the necessary tests required to establish that finished parts are in a satisfactory condition, knowledge of workshop processes, including welding, case hardening, heat treatment, white metalling, and methods of protection against corrosion; the protection of engines from internal corrosion and deterioration during storage.

(ii) The general principles of testing and measuring horsepower, fuel and oil consumptions, &c., as applied to aero engines after complete overhaul.

(iii) A knowledge of—

(*a*) The general assembly adjustment and methods of testing the correct erection of the components for the particular type or types of aero engine for which the licence is required, including the safe allowances for deterioration, wear, distortion, balancing of parts, &c.

(*b*) The methods of adjustment, and testing of carburettors, starters, pumps, &c., that are fitted to the particular type of engine, and for minor repairs for adjustment of magnetos.

(iv) Knowledge of methods of inspection and checking the correct functioning of the ignition, carburetion, lubrication, and cooling systems on the engine during tuning up and testing.

(v) For licences to include supercharged engines, a knowledge of the principles of super-charging, method of construction, and functioning of supercharger unit and boost control and experience in ground testing of supercharged engines.

(vi) For licences to include compression ignition engines, a knowledge of construction of the fuel injection system and the methods of fuel regulation.

DIVISION "C."

INSPECTION OF AIRCRAFT BEFORE FLIGHT.

20. The general principles of systematic examination of aircraft before flight, including:—

(i) Knowledge of—

(*a*) the methods of inspecting and checking the assembly of the whole of the aircraft structure;

(*b*) the rigging of an erected aircraft;

(*c*) the adjustment and functioning of the flying controls;

(*d*) the correction of faults that may be experienced in flight.

(ii) Knowledge of the defects and deterioration in wing coverings, timber and metal members, metal fittings, airscrews, streamline wires, tie rods, cables, shock absorbing devices, splices and joints, and other parts of the aircraft structure that may be expected to occur as the result of wear and tear, or may be produced by slight mishaps experienced during normal operation of the aircraft, and a knowledge of the methods of effecting minor repairs and replacements.

(iii) Knowledge of the methods of inspecting and testing the installation of the flying instruments, including compass adjustment and the automatic pilot for correct functioning.

(iv) Knowledge of the methods of inspection, testing, and operation of aircraft hydraulic, electrical, oxygen, and instrument services, including the gyro-pilot.

(v) For licences to include seaplanes or flying boats, a knowledge of the methods of erection, truing up, and maintenance of hulls and floats of both wood and metal construction.

(vi) For licences to include maintenance of controllable pitch and constant speed airscrews, a knowledge of the construction, functioning, and maintenance of these airscrews.

DIVISION "D."

INSTALLATION AND INSPECTION OF AERO ENGINES BEFORE FLIGHT.

21. The general principles of the inspection and testing of aero engine installation and maintenance, including:—

(i) Knowledge of the general construction of the particular type or types of engine for which the licence is required together with running permissible before overhaul, the extent of dismantling, the method of carrying out top overhaul, the defects likely to be encountered and the permissible allowances for wear and distortion, the methods of inspection and testing during and after top overhaul to ensure correct assembly and functioning.

(ii) Knowledge of carburetion, including mixture control and ignition principles, methods of examining and testing the correct erection of the power plant and its accessories in the aircraft, including the fuel, oil, cooling, ignition, induction, and exhaust systems, tanks and pipe lines, engine controls, and airscrews, together with the characteristic defects.

(iii) Knowledge of the inspection, adjustment, and testing of power plant and its accessories to ensure correct functioning and power output after installation in the aircraft and during daily maintenance, including airscrews, magnetos, carburettors, pumps, filters, engine starters and starting mechanism, and other parts or components of usual condition, on the correct functioning of which the power plant depends.

(iv) Knowledge of the methods of inspecting and testing the installation of the instruments connected with the power plant concerned to ensure correct functioning, including pressure gauges, temperature and revolution indicators, boost gauges, and tank contents gauges.

(v) For licences to include supercharged engines, a knowledge of the principles of supercharging, the operation of superchargers, the method of boost control, and experience of ground testing of these engines.

(vi) For licences to include compression ignition engines, a knowledge of the fuel injection system and method of regulation.

(vii) For licences to include maintenance of controllable pitch and constant speed airscrews, a knowledge of the construction, functioning and maintenance of these airscrews.

(viii) For licences to include electrical services, a knowledge of the methods of inspection and testing the installation concerned for correct functioning.

DIVISION "X."

OTHER PURPOSES FOR WHICH LICENCE REQUIRED.

22. Licences in Division "X" are issued for the purpose of covering other activities of Ground Engineers which, in accordance with Air Navigation Regulations, are required to be performed by licensed personnel. Licences in Division "X" have been issued in respect of the following sub-divisions:—

(i) Adjustment, installation, and compensation of compasses in aircraft.

(ii) Inspection and testing after repair or overhaul of aircraft ignition apparatus.

(iii) Inspection and testing after repair or overhaul of aircraft electrical equipment.

(iv) Inspection, testing, and calibration after repair or overhaul of—

(*a*) Aircraft and engine instruments operated mechanically but not gyroscopically.

(*b*) Aircraft and engine instruments operated gyroscopically.

(*c*) Aircraft and engine instruments operated electrically.

(*d*) Aircraft magnetic compasses.

(v) Inspection during manufacture of copper tubing.

(vi) Inspection, packing, and maintenance of parachutes.

(vii) Inspection during overhaul of controllable pitch airscrews.

(viii) Inspection of crankshafts after re-grinding.

(ix) Inspection of crankcases after re-boring.

(x) Inspection during manufacture of wooden airscrews.

(xi) Inspection during manufacture of wooden seaplane floats.
(xii) Inspection during manufacture of aircraft metal fittings.
(xiii) Inspection during manufacture of white metal bearings.
(xiv) Inspection during manufacture of white metal bearing alloys.
(xv) Inspection during manufacture of engine components.
(xvi) Inspection during manufacture of aircraft magnetic compasses.
(xvii) Inspection during manufacture of aircraft dopes, dope ingredients, and finishes.
(xviii) Inspection during manufacture of casein cement.
(xix) Welding of aircraft fittings and structures.

(xli) amended — Inspection and certification of electrical services on aircraft, for which the Licence is endorsed.

(xlv) — (a) Inspection during and testing after anodising, nickel and cadmium plating of aircraft parts and materials.
(b) Inspection during and testing after hard and porous chrome plating.

(xlvi) — Inspection during manufacture, testing and calibration of aircraft engine instruments.

(xlvii) — Inspection during manufacture of aircraft electrical components.

(xlviii) — Inspection during manufacture of carbon brushes.

(xlix) — Inspection during manufacture and after overhaul of aeronautical pumps.

(l) — Inspection, testing and repair or overhaul of aircraft carburettors:
(a) Injection Type.
(b) Float Type.
(c) Diaphragm Type.

(li) — Inspection and certification of hydraulic services on aircraft for which the licence is endorsed.

(xi) Inspection during manufacture of wooden seaplane floats.
(xii) Inspection during manufacture of aircraft metal fittings.
(xiii) Inspection during manufacture of white metal bearings.
(xiv) Inspection during manufacture of white metal bearing alloys.
(xv) Inspection during manufacture of engine components.
(xvi) Inspection during manufacture of aircraft magnetic compasses.
(xvii) Inspection during manufacture of aircraft dopes, dope ingredients, and finishes.
(xviii) Inspection during manufacture of casein cement.
(xix) Welding of aircraft fittings and structures.
(xx) Radio—
(*a*) Inspection after overhaul or repair of aircraft radio apparatus and installation.
(*b*) Inspection during and testing after manufacture of aircraft radio apparatus.
(*c*) Inspection before flight of an aircraft radio apparatus.
(xxi) Inspection during manufacture of aircraft tubes and tyres.
(xxii) Inspection during manufacture of aircraft accumulators.
(xxiii) Inspection during manufacture of tanks and cowlings.
(xxiv) Inspection of aircraft steels.
(xxv) Inspection during manufacture of aircraft plywood.
(xxvi) Inspection during manufacture of non-ferrous metals and alloys.
(xxvii) Inspection during manufacture of rubber components, not including tyres and tubes.
(xxviii) Inspection during manufacture of magneto contacts.
(xxix) Inspection during manufacture of aero engine copper-asbestos gaskets.
(xxx) Inspection during manufacture and after repair of parachutes.
(xxxi) Inspection during manufacture of safety belts, lap straps, and safety harness.
(xxxii) Inspection of manufactured petroleum products.
(xxxiii) Inspection during manufacture of hydraulic fluids for aircraft.
(xxxiv) Inspection during manufacture, overhaul, or repair, of aircraft wooden parts or components.
(xxxv) Inspection during manufacture, overhaul, or repair, of aircraft metal parts or components.
(xxxvi) Inspection during manufacture of standard aircraft parts.
(xxxvii) Inspection during manufacture and after overhaul or repair of controllable pitch airscrews.
(xxxviii) Inspection during overhaul of hydraulically operated components.
(xxxix) Inspection during manufacture of sparking plugs.
(xl) Inspection during manufacture of aircraft wheels.
~~(xli) Inspection and certification of electrical services on aircraft.~~
(xlii) Inspection during protective treatments of aircraft metal fittings and parts.
(xliii) Inspection and testing of aircraft timbers (including plywood and glue).
(xliv) Inspection and certification of instrument services on aircraft.
~~(xlv) Inspection during and testing after anodising, nickel, cadmium, and hard chromium plating of aircraft parts and materials.~~

DIVISION "X."

SYLLABI.

23. As a guide to Ground Engineers desirous of sitting for examination in Division "X", the following syllabi relating to those subdivisions more generally applied for have been prepared:—

(i) Adjustment, installation and compensation of compasses in aircraft.

(*a*) The general principles of magnetism; magnetic materials, and permanent magnets; polarity and strength of bar magnets (*e.g.*, corrector magnets); the earth as a magnet; magnetic meridian and its relationship with geographic meridian.

(*b*) The general construction of a typical aircraft compass including magnet system, damping liquid, verge ring and markings, lubber line, grid wires, shock absorbing suspension and corrector box; the common defects that may arise in use such as pivot friction, discolouration of liquid, and air bubbles; points to be observed in installing a compass in an aircraft.

(*c*) The compensation of compasses in aircraft, including the observation of deviations, the calculation and methods of correcting for co-efficients A. B and C; the sizes and use of corrector magnets and the procedure to be followed after correction including the preparation of deviation cards.

(*d*) The compensation of compasses in aircraft (or the checking of a "swinging" base) by means of a landing compass; the compensation of compasses in aircraft afloat by means of a landing compass ashore or by bearing plate or bearing compass on the aircraft.

(ii) Inspection and testing during repair or overhaul of aircraft ignition apparatus.

(1) The general principles of inspecting and testing aircraft engine ignition apparatus during complete overhaul and repair including:—

(*a*) General principles and construction of the types of magnetos fitted to aircraft engines including screened types.

(*b*) Methods of carrying out overhaul and repair, and defects likely to be encountered and the permissible allowances for wear and for deterioration.

(*c*) Inspection and checking of the components and assembled apparatus—mechanical, electrical and magnetic.

(*d*) Equipment required and methods to be used in carrying out functional tests after overhaul.

(2)—

(*a*) General principle and construction of impulse starters.

(*b*) Methods of carrying out complete overhaul, repair and testing of impulse starters.

(3)—

(*a*) General principle and construction of automatic timing devices.

(*b*) Methods of carrying out complete overhaul and testing of automatic timing devices.

(4) Ignition cable, including metal braided and fittings, knowledge of general construction, deterioration and defects, effect of metal braided cable on magnetos.

(5) Sparking plugs—methods of carrying out overhaul and testing.

(iii) Inspection and testing after repair or overhaul of aircraft electrical equipment.

(1) Elementary knowledge of electricity and magnetism and the secondary accumulator cell.

(2) The general principles of construction, operation and repair of—

(*a*) Electrical generators, motors and starters, including shunt series and compound wound machines.

(*b*) The third brush, Leitner type voltage control.

(*c*) Independent voltage controllers of the Tirrill type with details of adjustment.

(3) Conventional bench tests applied to small aircraft electrical generators, i.e., load/temperature runs, efficiency, flash tests, determination of copper losses and insulation resistance, together with any other tests required satisfactorily to prove the items of equipment referred to in paragraph (2).

(4) Methods of detecting common faults peculiar to equipment mentioned in paragraph (2).

(5) General testing of accumulators including capacity cycles and deductions to be made from data obtained from the specific gravity and voltage readings obtained during such tests.

(iv) Inspection, Testing and Calibration after repair or overhaul of—

(*a*) Aircraft and engine instruments operated mechanically but not gyroscopically.

(*b*) Aircraft and engine instruments operated gyroscopically.

(*c*) Aircraft and engine instruments operated electrically.

(*d*) Aircraft magnetic compasses.

(1) The examination will normally be written and oral in the subjects shown below, but in special cases candidates may also be required to give some practical proof of their ability.

(2) An elementary knowledge of physics.

(3) The general principles of construction, operation and repair of any aircraft instruments for which a licence is required.

(4)—

(*a*) Methods of calibrating and final testing of aircraft instruments, including high and low temperatures and vibration tests.

(*b*) Principles employed in the sub-standard apparatus normally used in the Instrument Repair Shop for calibrating purposes.

(*c*) Method of testing the accuracy of sub-standard test apparatus.

(5) The effects of variation and adjustment on instrument mechanisms.

(6)—

(*a*) Types of failures which may develop and steps to prevent recurrence.

(*b*) Methods adopted to trace failures and their causes.

(x) Inspection during manufacture of wooden airscrews.

A candidate is required to have a good knowledge of the complete process of wooden airscrew manufacture, including the following:—

(1) Conversion and specification of timbers suitable for airscrew construction, together with characteristic defects which render them unsuitable. Knowledge of the various workshop processes and methods of laying out and construction, including gluing, fabric covering, doping and varnishing, machining, boring and drilling, shaping, &c.

(2) Knowledge of methods of inspection and testing the airscrew in the white for accuracy of angles, dimensions, track, balance and alignment, and general finish.

(3) Knowledge on the allowable tolerances on angles, chords, maximum thickness, diameter and track, and balance and alignment of blades.

(4) Application and design of metal sheathing, fabric covering and/or other finishing processes to new or repaired airscrews.

(5) Inspection procedure in connection with the finished airscrew and precautions during storage.

(xii) Inspection during manufacture of aircraft metal fittings.

(xxxv) Inspection during manufacture, overhaul or repair of aircraft metal parts or components.

(1) Knowledge of metallic materials and specifications, methods of identification, examination and testing, characteristic defects which render then unsuitable, and precautions to be observed during processes of manufacture, heat treatment, welding, brazing, soldering, plating and other electrolytic processes, etching, pickling, bending, machining, riveting, &c.

(2) Knowledge of the methods of construction, examination and testing of metal aircraft parts and components, fuselages, wings, under-carriages, &c.

(3) Knowledge of processes for protection of hulls, floats and metal fittings against corrosion.

(xix) Welding of aircraft fittings and structures.

(1) Theory of welding. Gases used and method of determining purity. Equipment used, method of operation, flames used, care and maintenance, safety precautions.

(2) B.S.I., D.T.D., S.A.E. specifications for welding materials. Fluxes used in welding. Treatment of welds after welding light alloys, steels, inspection of welds for carburizing, penetration, oxidizing, fusing, &c.

(3) Stress set up due to welding. Method of controlling deformation during welding, castings, tubular structures.

(4) Manufacturers' approved welding repair schemes, British and American.

(xx) Radio—

(*a*) Inspection after overhaul or repair of aircraft radio apparatus and installation.

(*b*) Inspection during and testing after manufacture of aircraft radio apparatus.

(*c*) Inspection before flight of an aircraft radio apparatus.

(1) An applicant for a Ground Engineer's Licence, Division "X", Radio (*a*) shall—

(i) Be in possession of a current 1st Class Certificate of Proficiency in Radio Telegraphy and Radio Telephony issued by the Postmaster-General's Department.

(ii) Pass such examination as may be required by the Department of Civil Aviation.

(iii) Satisfy the Department as to his experience being such as to make him a suitable person to hold such licence.

(2) An applicant for a Ground Engineer's Licence, Division "X", Radio (*b*) shall be a responsible member of the staff of the manufacturer who shall be nominated to, and accepted by, the Department of Civil Aviation. Before the granting of such a licence the applicant will be required to—

(i) Pass such examination as may be considered necessary by the Department.

(ii) Satisfy the Department as to his experience being such as to make him a suitable person to held such a licence.

(3) An applicant for a Ground Engineer's Licence, Division "X", Radio (*c*) shall—

(i) Be in possession of a 1st or 2nd Class Certificate of Proficiency in Radio Telegraphy and Radio Telephony issued by the Postmaster-General's Department.

(ii) Satisfy the Department of Civil Aviation as to his experience being such as to make him a suitable person to hold such a licence.

(4) The examination referred to in sub-paragraph (1) (ii) above shall be based on the airworthiness requirements of the Department of Civil Aviation insofar as they apply to radio apparatus.

(5) The requirement under (1) (iii) and 3 (ii) above shall be judged on the applicant's previous experience and answers to questions related to the practical aspect of inspection and maintenance of aircraft radio equipment.

(6) Examinations shall be oral and/or written, and conducted at capital cities at such times as suit the mutual convenience of the applicants and the Department.

(xxiii) Inspection during manufacture of tanks and cowlings.

(1) Knowledge of metallic materials and specifications, methods of identification, examination and testing, characteristic defects which render them unsuitable, and precautions to be observed during processes of manufacture, heat treatment, welding, brazing, soldering, plating and other electrolytic processes, bending, riveting, &c.

(2) Knowledge of the various methods of tank construction, cowl fabrication and design, examination and testing of petrol, oil and header tanks, pressure, flow and capacity tests; protective processes.

(xxxiv) Inspection during manufacture, overhaul or repair of aircraft wooden parts or components.

(1) knowledge of non-metallic materials and specifications including knowledge of the identification and conversion of all species of timbers, together with characteristic defects which render them unsuitable, and the methods of testing to prove the quality of such materials.

(2) Knowledge of the methods of construction and examination and testing of wooden aircraft parts and components, fuselages, wings, airscrews (repair only), and covered parts.

(3) An elementary knowledge of ferrous and non-ferrous materials and their heat treatment.

(4) A knowledge of workshop processes such as gluing, fabric covering, doping, varnishing, wood machining, &c.

(vii) Inspection during overhaul of controllable pitch and constant speed airscrews.

(xxxvii) Inspection during manufacture and after overhaul or repair of controllable pitch and constant speed airscrews.

Candidates for the above subdivisions will be required to undergo a written and oral examination in the following subjects:—

(1) Materials used in construction and/or overhaul and general knowledge of heat treatment and testing of materials.

(2) General principles of the construction of controllable pitch and constant speed airscrews of the type or types for which the licence is required. The particular operating systems relating to these airscrews (hydraulic, electric).

(3) Inspection of finished parts for dimensions, weight and balance, knowledge of methods employed for correcting parts for weight or balance, clearances and allowances for wear and distortion of parts, adjustments and functioning tests.

(4) Rectification of defects and embodiment of modifications.

(5) Assembly of airscrew to engine, check testing, adjustment for performance.

(xxxviii) Inspection during overhaul of hydraulically operated components.

1. Knowledge of various types of hydraulic fluids and their composition, the effects on packings, cups and washers, precautions to be taken against contamination of the fluid.

2. Knowledge of the construction of various types of shock struts, retracting rams, hydraulic brake gear, differential cylinders, master cylinders, pressure regulators, unloading valves, accumulators, pumps and their assembly, adjustment and test.

3. Knowledge of test required to check the functioning of the complete hydraulic system of an aircraft after overhaul.

(xlii) Inspection during protective treatments of aircraft metal fittings and parts.

1. Knowledge of the following methods of preventing corrosion in various alloys, including:—

(*a*) Use of varnishes and enamels and their specifications.

(*b*) The electro deposition of a metal possessing corrosion resisting qualities, such as zinc and cadmium coating as in Division "X" (xlv).

(*c*) Approved proprietary processes such as feezing, platinising, scarabising, sherardising, surf alloy and zinc alloy, involving the deposition of zinc under heat, fescolising involving the deposition of nickel, calorising involving the formation of surface alloy of aluminium with steel, coslettising involving an iron phosphate coating.

(*d*) Knowledge of descaling methods and treatments.

(*e*) Treatment of wrought light aluminium and its alloys by the anodizing process as in Division "X" (xlv).

(*f*) Treatment of brass and bronze alloys.

DIVISION "X."

SYLLABI.

(xlv) Inspection during and testing after anodising nickel, cadmium and hard chromium plating of aircraft parts and materials.

1. General knowledge of the electroplating process, including suitability of plant used, methods adopted for its operation, and those adopted to remove brittleness, and of physical tests to ensure compliance with specification requirements.

2. Knowledge of preparation of parts prior to electro deposition, including cleaning processes.

3. Knowledge of composition and control of the plating bar for each process.

In special cases candidates may be required to give some practical proof of their ability.

Ground Engineer's licences in Division "X" in any subdivision will not be issued unless the applicant has access to or is in possession of approved equipment for carrying out the duties specified on the licence.

The approval of workshop and testing facilities is also essential before authority will be given for the issue of Release Notes or Certificates of Repair. In this connection the applicant is referred to Technical Memoranda on this subject issued by the Department, copies of which may be obtained on application.

NOTES IN REGARD TO THE EXTENSION OF GROUND ENGINEERS' LICENCES FOR TYPES OF AIRCRAFT AND/OR ENGINES WITHIN DIVISIONS ALREADY HELD BY AN APPLICANT.

24. In connection with the extension of a Ground Engineer's Licence for types of aircraft and/or engines within a Division already held by an applicant, the following procedure will normally be adopted:—

Division "A".—When the applicant has a licence in this Division which is endorsed for "all metal" types of aircraft, and desires the addition of wooden or composite types, or vice versa, it will be necessary for the applicant to undergo a complete examination, i.e., a written, oral, and practical test.

Divisions "B" and "D".—When the applicant has a licence in either of these Divisions which is endorsed for low powered engines, and desires the addition of radial or supercharged types fitted with controllable pitch or constant speed airscrews, the applicant will be required to undergo a written and oral examination on the types applied for.

Division "C".—When the applicant has a licence endorsed for small or light types of metal or wooden aircraft and submits an application for the addition of large transport type aircraft in metal, wooden or composite construction equipped with retractable undercarriage, controllable pitch or constant speed airscrews, and extensive electrical, hydraulic and instrument equipment, the

applicant will be required to undergo a written and oral examination on the types applied for. If the applicant has the larger types and requires endorsement for the lighter machines, then an oral examination only will be required.

The procedure outlined above in regard to the endorsement of licences is that which would be normally adopted by the Department, but certain cases which merit special consideration may arise, and in these cases the above procedure may be modified at the discretion of the examining officers.

AIR NAVIGATION REGULATIONS.

25. Candidates will be required to indicate that they are conversant with the provisions of the Air Navigation Regulations, particularly in regard to the registration and airworthiness of machines, and certifying aircraft as safe for flight.

26. Applicants for Ground Engineer's Licences are advised to obtain and study the Makers' Handbooks for the particular type or types of aircraft and/or aero engines, accessories and material specifications, for which a licence is desired, also suitable text books.

27. Candidates are particularly to note that in order to qualify for a licence in Division "A" they must also qualify in the subjects listed under Division "C", and for a licence in Division "B" they must also qualify in the subjects listed under Division "D".

28. Licences will not be issued to persons under the age of 21 years.

By Authority: H. E. Daw, Government Printer, Melbourne.